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# Utilization of Ultrasonic Waves (*Acheta domesticus*) as a Biocontrol of Mosquito in Malang Agricultural Institute

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**Abstract.** Malang Agricultural Institute is a college located in the residential area Griyasanta Malang. The environment around the Institute of Agriculture Malang has moist soil conditions so that mosquito species insects easily reproduce. It is feared that this problem can potentially cause many diseases caused by mosquitoes such as dengue fever, malaria, chikungunya, elephant legs and much more. Nowadays there has been considerable research on ultrasound waves against mosquitoes. Many studies have been done to determine the effect of ultrasonic waves on mosquitoes. Crickets have frequencies between 0.2 kHz–50 kHz so it has the potential to control mosquito pests. Existing studies indicate that mosquito pests can be expelled with the frequency of 18–48 kHz. But this still cannot eliminate mosquito larvae that require a wave of 85 kHz. The effects of ultrasound waves on mosquitoes are (1) erection of the antenna which shows the stress on the nervous system to physical injury and fatigue so as to increase the percentage of fall and the death of mosquitoes. (2) ultrasonic waves can make the antenna function in the mosquito as the receiver of excitatory disturbed. The ultrasonic wave can be defined as a threat so that the mosquito will be expelled. Based on this, a simple study was conducted at the campus of the Institute of Agriculture of Malang by taking 10 different locations with randomly assigned respondents with a maximum of 5 people per location. The results show that the effectiveness of the use of crickets in the morning reached 60% and in the afternoon reached 80% starting on the first day since the installation of crickets. So the use of these crickets in the campus environment of the Institute of Agriculture Malang is quite effective.

## INTRODUCTION

Most areas in Indonesia have conditions with humid soil, not to mention the environment around the Agricultural Institute of Malang (AIM). As a result of these natural conditions mosquito species insects easily reproduce. It is feared that this problem can potentially cause many diseases caused by mosquitoes such as dengue fever, malaria, chikungunya, elephant legs and much more. Various preventive measures have been taken to reduce the incidence of mosquito-mediated diseases from eradicating mosquito larvae, fogging, burning / electric mosquito coils, use of bed nets, using mosquito repellent, spraying insecticide insecticides, mosquitoes in windows/ventilation, taking preventive medication when traveling to endemic areas (malaria only), and others.<sup>1</sup> Almost all of these actions use chemicals that of course will not be good for the health. Fogging and mosquito repellent can kill adult mosquitoes but their larvae still remain.<sup>2</sup>

Ultrasonic waves have the potential to control mosquito pests.<sup>3</sup> The advantage of using ultrasonic waves is this action does not cause environmental pollution, does not cause sounds that affect the human ear because of its frequency beyond the normal human hearing range, and can kill mosquito larvae and the adult mosquitoes thermally due to heat effects caused, and other effects that ultrasonic waves are generated.

Therefore, it is necessary to develop a technique of mosquito-based pest control on the utilization of ultrasonic waves more effectively and efficiently, one of which is the biocontrol of mosquito pests by using crickets (*Acheta domesticus*).

Crickets are insects that use sound (sound waves) as a means of communication among fellow crickets. Cricket sound waves have a range above the sound frequency of human hearing sounds, these waves include ultrasonic waves. The preparation of this paper is expected to contribute scientific information about the potential of crickets as a mosquito repellent in applying an eco-green campus system that is cheap, easy, and quick to reduce the impact of the disturbance and the spread of disease caused by mosquitoes.

## EXPERIMENTAL DETAILS

The experiment was done by separating male and female crickets in different cages. This is to stimulate males who want to continue to mate with high frequency. The female feature is to have an ovipositor shaped like a stick that is not possessed by a male (Figures 1a and 2b). Then the bites experienced by students, lecturers and employees were counted before and after crickets were installed on the campus of the Institute of Agriculture of Malang with a maximum number of 5 participants per location. Data collection was done 2 times i.e.:

### 1. In the morning

Performed at around 06:00 until 09:00 p.m., this was done because at this hour mosquitoes start to actively come out to look for food. Implementation of activities carried out by means of crickets being placed in a free room (without a certain barrier) that is in the gazebo (Figure 1C), and observed the number of mosquito bites to humans in the morning and compared with the number of bites on a typical day before there are crickets.

### 2. In the afternoon

The experiment for this afternoon is from 16:00 to 19:00. In these hours the mosquitoes reactivate as the air temperature in the afternoon begins to decrease, which is the temperature currently suitable for mosquitoes.

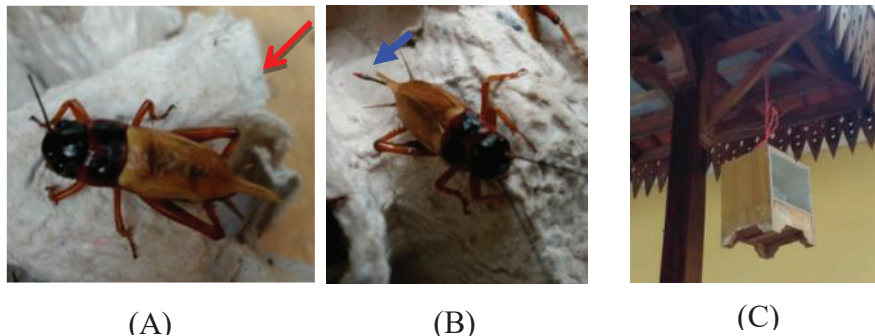


FIGURE 1. (A) Male, (B) females crickets, and (C) the cricket cage



**FIGURE 2.** Environmental condition of Agricultural Institute of Malang

## RESULT AND DISCUSSION

**TABLE 1.** Number of bites before and after cricket application

Location	Number of bites			
	Morning		Afternoon	
	Before	After	Before	After
Gazebo	4	0	3	0
House of mushrooms	5	1	5	2
Laboratory	2	1	3	0
Employee space	3	1	2	0
Lecturer Room	3	0	2	0
Rector's room	4	2	3	1
Classroom	4	0	2	0
Mapalipma (Nature Conservation Student Association)	3	0	1	0
BEM (Student Executive Board)	4	0	1	0
Parking Area AIM	5	0	3	0

From Table 3, it is seen that the change in the incidence of mosquitoes decreased and this occurred after  $1 \times 24$  hours of crickets being installed. As for some places like mushroom houses, laboratories, employee space, rector chambers still have the incidence of mosquito bites predicted due to the high temperature and humidity of the air in the venue. The intensity of vibration in ultrasonic waves will decrease when the temperature or humidity in the destination is high enough. Wilson (1972)<sup>4</sup> states that the range of ultrasonic wave signal transmission depends on the temperature, humidity, and frequency of the signal itself. If the temperature and humidity constant, the higher the frequency of the signal and the greater the absorption in the air. Temperature and humidity determine the high frequency, considering ultrasonic waves are sound waves that require air as a propagation medium.

In addition, another factor is that mosquitoes can detect 3 important things as their preferred condition, which is heat, color (darkness) and smell (females: blood and acids, male: nectar, nutrition)<sup>5</sup> which is high in the morning. So some places have mosquitoes.

High humidity will speed up the evaporation from the body of the mosquito so that the loss of water will quickly take place. To maintain the water balance in the body, mosquitoes get fluid from food, causing mosquitoes to eat repeatedly<sup>6</sup>. In addition, mosquitoes also prefer a warm atmosphere where body temperature will affect the number of mosquitoes that landed.

The data above show that the effectiveness of the use of crickets in the morning reached 60% and in the afternoon reached 80%. So the use of these crickets in the campus environment of the Institute of Agriculture Malang is quite effective.

## SUMMARY

Crickets have frequencies between 0.2 kHz and 50 kHz. So they have the potential to control mosquito pests. Existing studies state that mosquito pests can be expelled with a frequency of 18–48 kHz. But this still cannot eliminate mosquito larvae, which require a wave of 85 kHz. The level of effectiveness of the use of crickets in the morning reached 60% and in the afternoon reached 80%. So the use of these crickets in the campus environment of the Institute of Agriculture Malang is quite effective.

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## REFERENCES

1. Ministry of Health of the Republic of Indonesia, Basic health research, *Riskedes* (2010)
2. D. Sarudji, Environmental Health, *Media Science* (2006).
3. Maskunah, "Effect of Ultrasonic Waves Against Suspension of Colloidal Bacteria," Research Report, Airlangga University, 1988
4. E. O. Wilson, *Science Am.* **227**, 52-60 (1972)
5. Ministry of Health of the Republic of Indonesia, Ecology and Aspects of Vector Behavior, *Directorate General of PP and PL Jakarta* (2007).
6. H. M. Abednego and T. Suroso, "Epidemiology Aspects of Dengue Hemorrhagic Fever (DHF) In Indonesia Today," in *Seminar of Dengue Hemorrhagic Fever* (1998).